

SECTION 2: DRAFTING PRACTICES

2.1 COMPUTER AIDED DRAFTING (CAD)

2.1.1 Standard File Format

The standard file format for submission of electronic CAD files to the Bridge Section is in a Microstation design file. Currently Bridge Section uses Microstation Version 8.1.

2.1.2 Directory Setup

Every XP Workstation has been set up with a similar directory diagram. This will enable any user to find information on another workstation efficiently. Project files **will be stored on the server under F:\ODOT_DATA\Projects\key #**. Every Workstation has a c:\share" directory. This will allow Drafters to share details freely.

Use Serval software when copying or moving a file from another workstation, rename the file to avoid multiple copies of one file.

Bridge Standard Drawings files can be found in a pdf format at:

<http://www.odot.state.or.us/tsspecs/std-dwg-02.htm>

and in dgn format at:

'Salem - Rev. Bldg 5th Floor - [\scdata\brdgp\bridge standard dgns\](#)

When a standard drawing is placed on an individual workstation, change the file extension to .ref.

2.1.3 Cad Files

2.1.3.1 Drawings Start to Finish

1. CAD files created.
2. The design offices are responsible for obtaining the structure numbers, drawing numbers, and calc book numbers from the Bridge Data system (BDS) and headquarters Bridge Section.
3. "D" size (22" x 34") mylars are printed with appropriate bridge and drawings numbers.
4. 11" x 17" paper prints are created from the full sized stamped and signed bridge mylars.
5. Design office will provide "D" size bridge mylars and 11" x 17" paper prints to the Office of Pre-Letting in Salem headquarters.
6. Office of Pre-Letting will the send "D" size mylars to ODOT Reprographics for printing and scanning.
7. ODOT Reprographics is finished with scanning; they will send requested information back to the office of Pre-Letting. ODOT Reprographics will send Bridge Mylars and scanned images to Bridge Engineering Section front office in room 301 of the Transportation Building.

2.1.3.1 Drawings Start to Finish – (continued)

8. Bridge Engineering Section Headquarters will load scanned images into the Bridge Data System (BDS), log the Mylars into the tracking system, and then return the signed mylars to original design office.
9. At completion of construction, the Project manager will send as-constructed comments to the original design office for review by the Engineer of record.
10. Comments will then be placed by hand drafting on the original mylars.
11. Once as-constructed comments are completed, one new set of 11" x 17" paper prints will be provided to the Bridge Operations Engineer in Bridge Section Headquarters in Salem for data entry into PONTIS BMS.
12. Original as-constructed comments are returned to the Project Manager's office. "D" size Mylars are returned to Bridge Section Headquarters, front office.

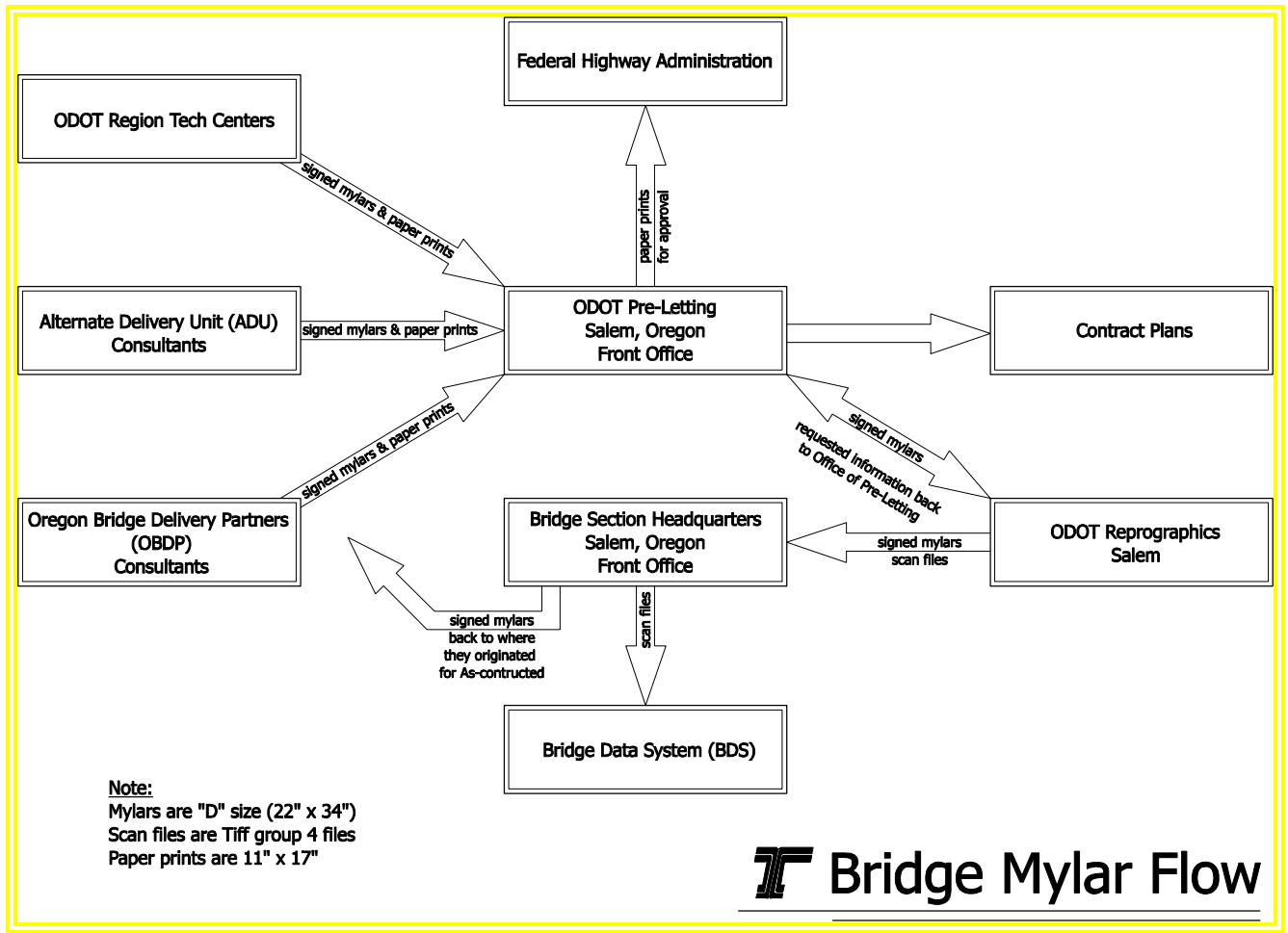


Figure 2.1.3.1A

2.1.3.2 What Bridge Headquarters Needs At Completion of a Design Project.

- “D” size mylars and 11” x 17” paper prints must be included as part of the PS&E submittal package provided to the ODOT Office of Pre-Letting. The 11” x 17” paper prints will be used for the project advertisement and bidding process.
- The submitted bridge mylars will be scanned and sent to the Bridge Engineering Section. The Bridge Section will return the mylars to original design office.
- After construction is completed, “D” size mylars should be sent to Bridge Engineering Section Headquarters in Salem with as-constructed comments hand drafted on them. Bridge Section will then place the as-constructed version in the Bridge Data System (BDS) and archive the mylars.
- Foundation Report.
- Hydraulics Report.
- All calculation books (Engineer of record and Checkers).
- Project Files to be archived per Records Retention Policy (Bridge will scan this information and then pass on to appropriate sections).
- Load rating of as-constructed bridge per Load Rating Guidelines.

2.1.3.3 Shared Details

2.1.3.3.1 Example Drawings

Example drawings of repair/retrofit and different structure types can be found at:

ODOT ftp site: [\\s0442c\ftp\Bridge\BDDM\Example_Drawings](ftp://s0442c\ftp\Bridge\BDDM\Example_Drawings)

For a complete list of Example drawings, see Appendix 2.1.3 CAD FILES.

2.1.3.3.2 Standard Details

Standard Details are a drawing that provides information about a given item, this drawing is un-stamped and made available only as details to help speed up the CAD process. Standard Details can be found at the following website:

[//egov.oregon.gov/ODOT/HWY/ENGSERVICES/standard_details.shtml](http://egov.oregon.gov/ODOT/HWY/ENGSERVICES/standard_details.shtml)

2.1.3.4 File Naming Conventions

All structures have different drawings such as Layout and Index drawings, Deck Plans, Bents, but 95% of all structures have similar drawing types. They may have multiples of each of these drawings, so use the coinciding span number or Bent number in the view name, such as Span 2 or Bent 1.

Drafter Initials, Bridge Number, File I.D. , extension (.dgn)

File Identification

L = Layout & Title Drawings

S = Superstructure Drawings

B = Substructure Drawings

Layout & Title Drawings

Layout and Index sheet

Plan and Elevation

General Notes

Foundation Data Sheet

Stage Construction

Miscellaneous Details

Work Bridge Details

Superstructure Drawings

Deck Plan

Deck Section

Framing Layout

Longitudinal Girder Elevation

Camber Diagram

Post-tensioning sheets

Rail Details

Substructure Drawings

Footing Plan

Plan and Elevation–Bent 1

Bent Details – Bent 1

Bearing Details – Bent 1

Wingwall - A Details

Shearlug

2.1.3.5 *Microstation Models*

All Title and Layout files (see Section 2.1.3) will have Existing Bridge Model and Proposed Bridge Model. See Figure [2.1.3.5A](#).

Existing Bridge model will have any existing information necessary for the project.

Proposed Bridge model will have alignment information obtained from Roadway Designer with the new bridge shown in the coordinate correct location. This model will be shared with Geo/Hydro Section for their use.

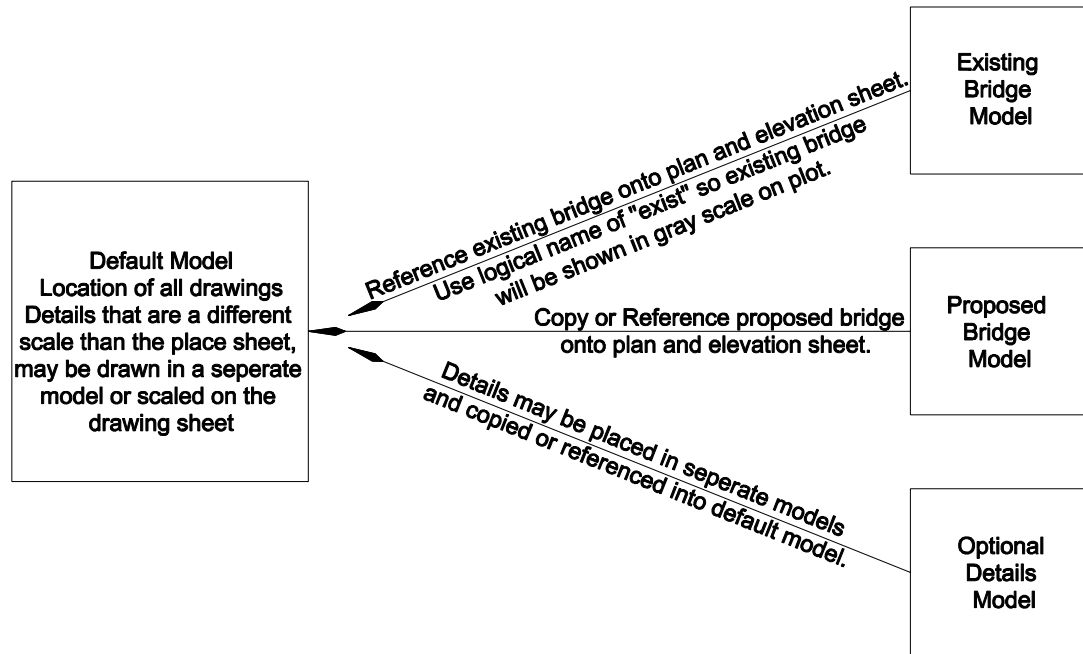


Figure 2.1.3.5A

2.1.4 *Cell Libraries*

All Microstation cell libraries reside on the server plus a personal cell library, for location see below.

Bridge Section Standard Cell Library

Location on server = ODOT_SPACE\Standards\Cell\Bridge.cel

For a paper copy of the cell library, see appendix A2.1.4

Personal Cell Library

Location on server = ODOT_DATA\ENG_APP\Cell\Personal Cell Library Name.cel

Registration Seal Cell Library

This Library shall be maintained by the Senior Bridge Drafter in each Region for their Professional Engineers. Place the file in:

Location on server = ODOT_DATA\ENG_APP\Cell\Registration Seals Library Name.cel

2.1.5 Menus

There are several types of menus that will be discussed below.

- Custom Palettes - A palette menu can be created in Microstation using Workspace>Customize. See Figure 2.1.5A.
- Function Key Menus - To set certain operations to function keys on your keyboard (F1, F2, ...), in Microstation use Workspace>Function Keys..., remember to save when finished. Each individual may have their own version of a function key menu.
- ODOT Menu - In Microstation, select the menu word ODOT and choose Menu from the drop down list. The ODOT Menu will open showing a greater then symbol ">". Click ">" to choose a menu from the drop down list containing Bridge, Construct, Existing, FDPlans, and others. See Figure 2.1.5B.

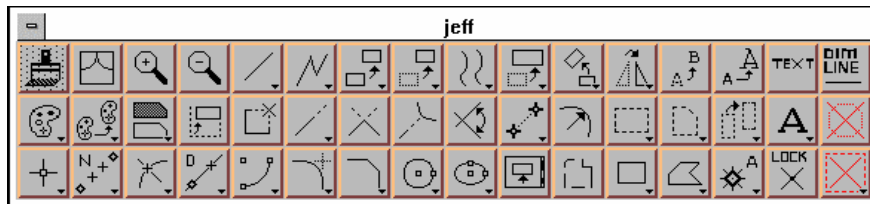


Figure 2.1.5A

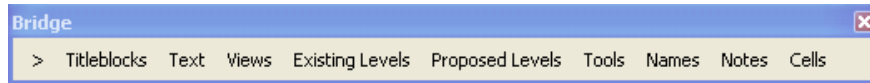


Figure 2.1.5B

2.1.6 Seed Files

Seed files are the beginning of every file, when creating a new file, the system copies your seed file to create a new file. ODOT seed files are located:

ODOT_SPACE\Standards\Seed\Seed2d.dgn
Seed3d.dgn
SeedRW2d.dgn

2.1.7 Color Table

The Bridge Section color table allows bridge elements to be display in different colors. Corresponding text for an given element will be a slightly different shade of the same color. By following this color scheme it allows you to quickly visualize the different bridge components. See Figure 2.1.7A for RGB color values.

BRIDGE COLOR TABLE VALUES

ct = brcolor.tbl

Color Components (RGB 0 - 255)

| Co = | Red | Green | Blue |
|------|-----|-------|------|
| 0 | 255 | 255 | 255 |
| 1 | 92 | 209 | 255 |
| 2 | 0 | 255 | 0 |
| 3 | 255 | 0 | 0 |
| 4 | 255 | 255 | 0 |
| 5 | 255 | 105 | 180 |
| 6 | 255 | 123 | 255 |
| 7 | 179 | 0 | 255 |
| 8 | 255 | 0 | 255 |
| 17 | 140 | 190 | 255 |
| 18 | 0 | 179 | 25 |
| 19 | 255 | 100 | 94 |
| 20 | 255 | 255 | 132 |
| 21 | 255 | 192 | 203 |
| 22 | 255 | 199 | 102 |
| 23 | 209 | 113 | 255 |
| 24 | 255 | 161 | 255 |

Figure 2.1.7A

2.1.8 Scales

When selecting a scale, keep in mind that the drawing will be reduced to half size. For any given structure, all plans should, whenever possible, be drawn at the appropriate scale for the same details. Sections and views may be enlarged to show more detail, but the number of different scales used should be kept to a minimum. When scaling CAD details, use Figure 2.1.8A. (An enlarged version is available from Drafters.)

The scale listed under each detail should read **Scale xxx = xxx** where xxx is the appropriate scale.

All drawings are drawn full size to a scale of 1:1. Only when they are plotted do they become the specified scale.

Common scales for bridge drawings:

- Plan & Elevation - Use an english scale and make the plan as large as possible. (Remember to save room for location map in the upper right corner and General Notes, if possible).
- Footing Plan - As large as possible
- Deck Plan - Use either a 1/8" = 1'-0" or 1" = 10'-0".
- Deck Section - Use either a 3/8" = 1'-0" or larger.
- Bents - The plan and elevation of Bents are drawn to 1/4" = 1'-0" or 3/16" = 1'-0".

Of course, these are suggested guidelines and remember, there are always situations that don't quite fit.

Following are the scale factors for English scales that are used for bridge drawings.

| Scale | Scale Factor |
|----------------|--------------|
| 3" = 1'-0" | 4 |
| 1 1/2" = 1'-0" | 8 |
| 1" = 1'-0" | 12 |
| 3/4" = 1'-0" | 16 |
| 1/2" = 1'-0" | 24 |
| 3/8" = 1'-0" | 32 |
| 1/4" = 1'-0" | 48 |
| 3/16" = 1'-0" | 64 |
| 1/8" = 1'-0" | 96 |
| 3/32" = 1'-0" | 128 |
| 1" = 60'-0" | 720 |
| 1" = 50'-0" | 600 |
| 1" = 40'-0" | 480 |
| 1" = 30'-0" | 360 |
| 1" = 20'-0" | 240 |
| 1" = 15'-0" | 180 |
| 1" = 10'-0" | 120 |

2.2 DETAILING

2.2.1 Text

Since all drafting is now done with the use of computers, use the following:

- General text – 5/32" font 24, wt=2
- Titles – 7/32" font 2, wt=3

Shortcut keys for special characters in font 24 are shown in Figure 2.2.1.

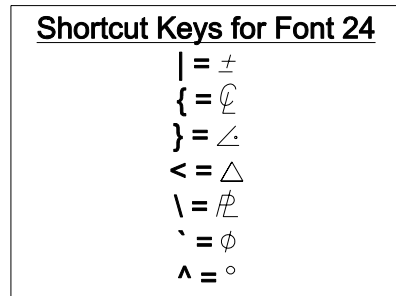


Figure 2.2.1A

Use ODOT Plans menu for setting text sizes, see Section 2.1.5 for information about Plans menu..

For abbreviations to use see Appendix Section A2.1.

Orient lettering to be read from the bottom or right edge of the sheet.

2.2.2 Line Work And Levels

All line work must be of sufficient size, weight and clarity so that it can be easily read from a print that has been reduced to one-half (1/2) the size of the original drawing. Similar lines denoting a structural outline, a centerline, etc., shall have the same line weight and style.

Use line weight with appropriate gradations of width to give line contrast as shown in Figure 2.2.2A. See Appendix Section A2.2.2 for Levels and designated line weights. Care shall be taken that the thin lines are dense enough to show clearly when reproduced. See Appendix Section A2.2.2 for Standard Symbols.

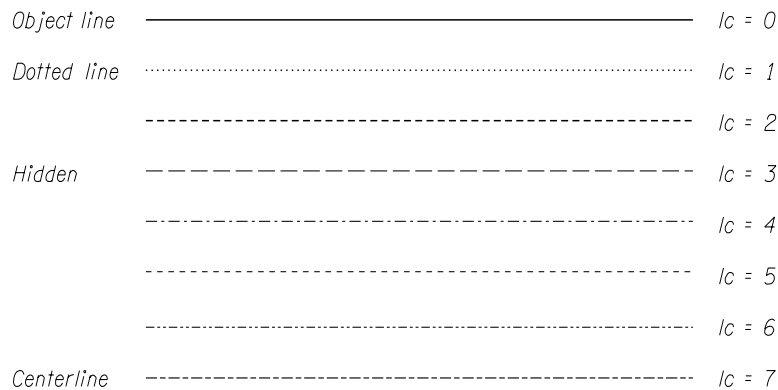


Figure 2.2.2A

2.2.3 Dimensioning

Avoid duplication and unnecessary dimensions. Place all dimension figures above the dimension line, so that they may be read from the bottom or the right edge of the sheet, as shown in Figure 2.2.3A.

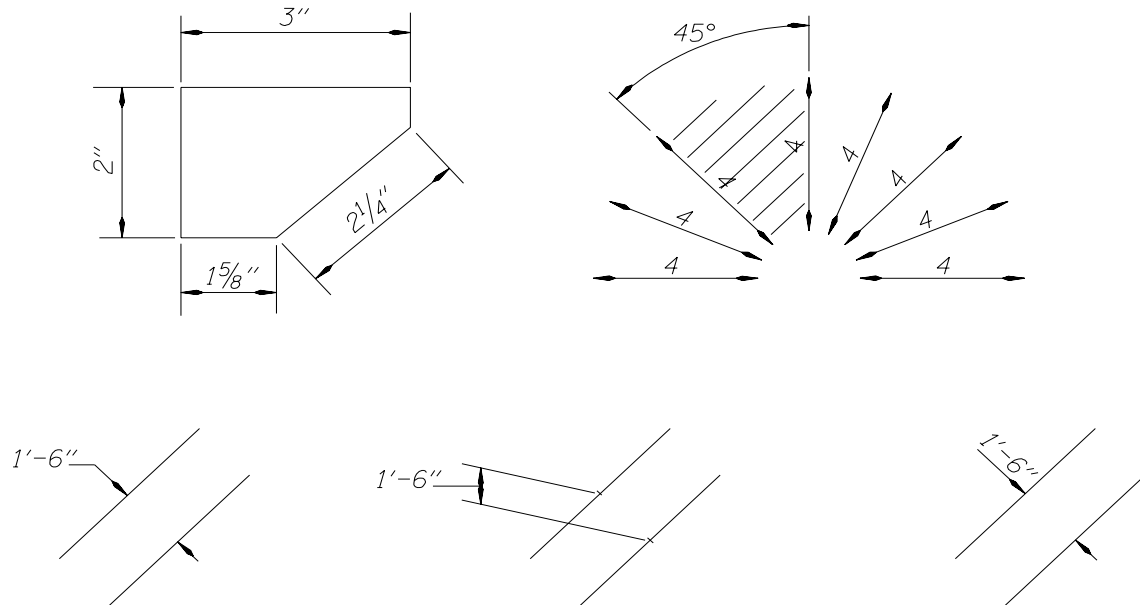


Figure 2.2.3A

In general, consider the precision of detail dimensions and the normal construction tolerances to which it is being constructed. General plan and detail dimensioning precision should not be more than the following:

- Structural Steel to 1/16"
- Welds to 1/16"
- Concrete to 1/8"
- Camber Diagrams to 1/8"
- If a series of dimensions (i.e. beam or rail post spacing) do not add up to the exact overall dimension, use a plus or minus (\pm) following the series dimension. (i.e. 25 spaces at $9'-3 \frac{1}{8}'' \pm = 231'-7''$)

2.2.3 DIMENSIONING – (continued)

Dimensions 12" or more are to be dimensioned in feet and inches, unless the item dimensioned is conventionally designated in inches (for example, 16" dia. pipe or #4 @ 18").

In dimensions more than 1 ft, fractions less than 1" are to be preceded by 0 (for example, 3'-0 1/8").

Intersection angles should be dimensioned as the acute angles between centerlines of roadways or between centerline of roadway and centerline of bent. Where the intersection is on a curve, measure the angle from the local tangent to the curve at the point of intersection. For intersecting curves, give the angle and add the words "tan - tan".

Placement of dimensions outside the view, preferably to the right or below, is desirable. However, in the interest of clarity and simplicity, it may be necessary to place them otherwise. Examples of dimensioning placement are shown in Figure 2.2.3B.

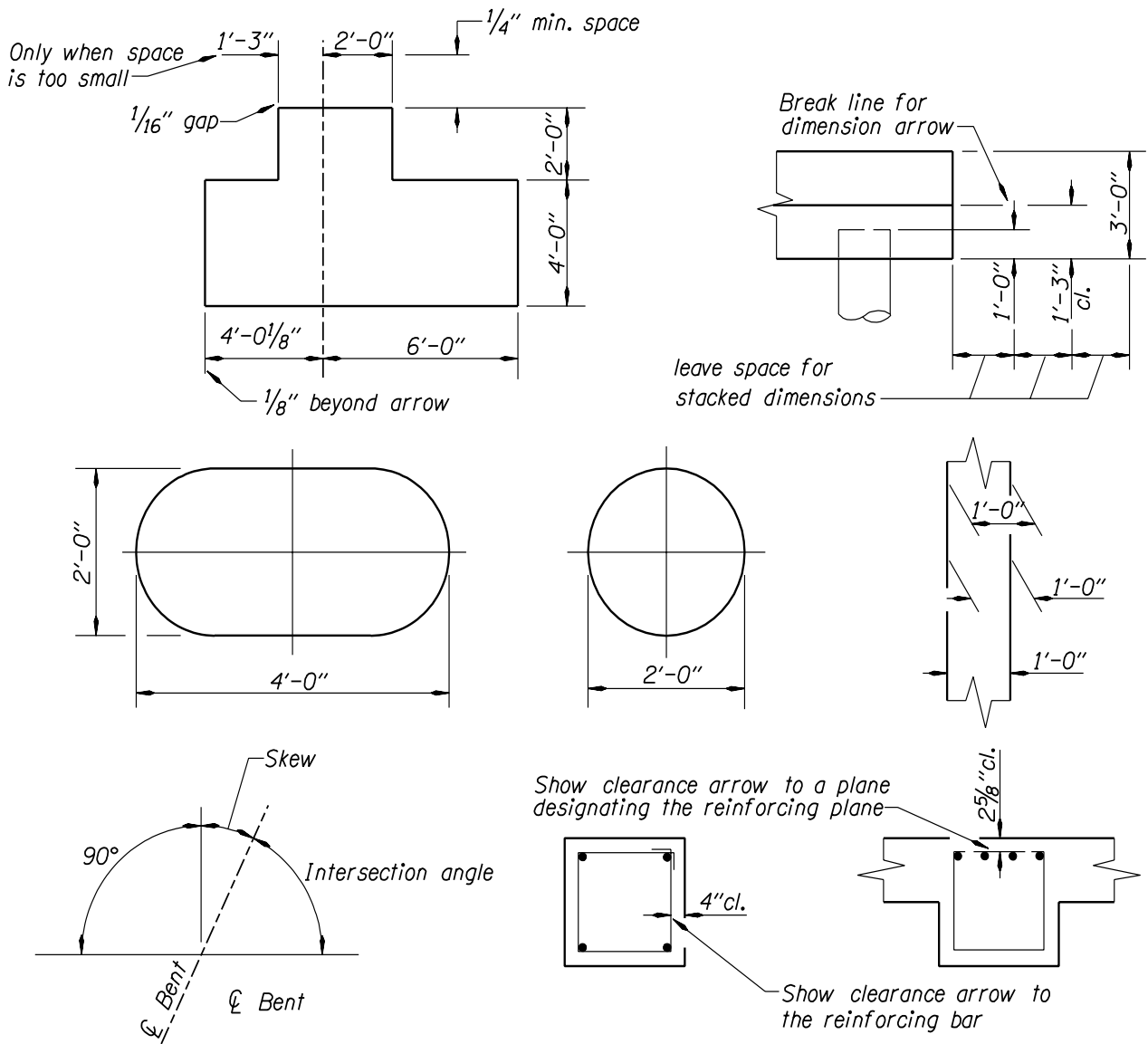


Figure 2.2.3B

Bridge Design and Drafting Manual - 2004
Oregon Department of Transportation

Bridge Design and Drafting Manual - 2004
Oregon Department of Transportation

Bridge Design and Drafting Manual - 2004
Oregon Department of Transportation

Bridge Design and Drafting Manual - 2004
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